SIO

2010

200053

PHYSICS II (Optional)

Standard : Degree **Total Marks : 200**

Nature : Conventional **Duration : 3 Hours**

Note :

*(i) Answers must be written in **English**.*

*(ii) Question **No. 1** is **Compulsory.** Of the remaining questions, attempt **any four** selecting one question from **each section.***

*(iii) Figures to the **RIGHT** indicate marks of the respective question.*

(iv) Make suitable assumptions, wherever be necessary and state the same.

(v) Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answer will not be assessed.

(vi) Credit will be given for orderly, concise and effective writing.

(vii) Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.

(viii) For each slab of 10 and 15 marks, the examine is exepected to write answer in 125 and 200 words.

1. Answer **any four** of the following (10 marks each) **40**

(a) Explain the term briefly:

(i) Dielectric constant,

(ii) Permitivity,

(iii) Hysteris,

(iv) coercivity.

(b) What is photo electric effect ? Discuss the experimental arrangement to study the Photo electric effect.

(c) Explain the following terms briefly:

(i) Directionality,

(ii) Intensity,

(iii) Monochromacity and,

(iv) Coherence.

State any four applications of Laser.

(d) What do you mean by remote sensing? Explain in brief about remote sensing satellite.

(e) Explain the working of Globle Positioning Satellite (GPS).

P.T.O.

Marks

SECTION - A

2. Answer the following sub-questions:

(a) An electric dipole consists of two equal and opposite charges ($\pm q$) separated by a distance d. Find approximate potential at point far from the dipole. **10**

(b) Define the quality factor of LCR resonance circuit, and prove that the quality factor Q of a series LCR circuit at resonance is given by $Q = \frac{1}{R}\sqrt{\frac{L}{C}}$. Explain the construction and working of ideal transformer. State its uses. **9** **6**

(c) State Poynting therorem. Show that the surface integral of the Poynting vector measures the rate of flow of electro-magnetic energy. **15**

3. Answer the following sub-questions:

(a) Derive an expression for an electric field due to an electric dipole at point on the axial line. **10**

(b) Define j-operator, using j-operator, obtain an expression for growth of current in L.R. circuit and define the time constant of L.R.circut. **15**

(c) State and explain in brief Maxwell's four electro-magnetic field equation. Explain the concept of displacement current. **15**

SECTION - B

4. Answer the following sub-questions:

(a) State de Broglie hypothesis. Describe an experiment in which, observations can be explained by using this hypothesis. **10**

(b) Derive Schrodinger's time independent wave equation and explain the physical significance of wave function. **15**

(c) State Schrodinger's equation for hydrogen atom in spherical co-ordinate and explain the significance of various quantum number defining a quantum system. **15**

5. Answer the following sub-questions:

(a) State and prove Heisenberg's uncertainty principle. Derive the relation between uncertainties in energy and time. **10**

(b) What is an operator? Obtain the operators for momentum and energy. Find the Eigen values for the operator $\frac{d^2}{dx^2}$ operating on the wave function $\Psi = \cos x$ **15**

(c) Explain briefly: **15**

(i) Space quantization and

(ii) Spin of electron.

Name the four quantum numbers of an electron and explain their significance.

Marks

SECTION - C

6. Answer the following sub-questions:
   (a) What are the differences between hydrogen spectra and alkali atom spectra? State different spectral series in alkali atom spectra and discuss their occurrence in brief. **10**
   (b) Using Born-Oppenheimer approximation, explain vibrational coarse structure of electronic spectrum of diatomic molecule. Find an expression for total wave number. **10**
   (c) Define the term 'binding energy of nucleus' shows how this concept is related to the stability of nucleus. **10**
   (d) What is nuclear reaction? Explain the importance of Q-Value of nuclear reaction. **10**

7. Answer the following sub-questions:
   (a) What is Zeeman effect? Describe the experimental arrangement of studying the Zeeman effect. **10**
   (b) What is Raman effect? Explain. State its importance. **10**
   (c) Write a short note on nuclear size. Derive relation between the radius of nucleus and its atomic mass number. **10**
   (d) State the comparison of fission and fusion nuclear reactions. Explain how fusion can be superior as a future source of energy in comparision to the fission reaction. **10**

SECTION - D

8. Answer the following sub-questions:
   (a) Define valance band, conduction band and Forbidden energy gap. Explain the classification of solids as conductor, semi conductor and insulator on the basis of bond picture of solids. **15**
   (b) What is doping? Explain N-type and P-type semi conductor. Draw energy level diagrams for N-type and P-type materials. **10**
   (c) (i) What is field effect transistor? Explain the construction and working principle of N-Channel JFET. **10**
   (ii) State and prove Demorgan's Laws. **5**

9. Answer the following sub-questions:
   (a) What are diamagnetic, Paramagnetic and Ferromagnetic substances. Obtain an expression for the susceptibility of a diamagnetic substance. **15**
   (b) What is meant by a hole? Explain energy band structure of an intrinsic semiconductor at absolute zero and at room temperature. What do you understand by recombination? **10**
   (c) (i) Explain the working of full wave rectifier using two P-N-junction diodes. Draw input and out put wave form. **10**
   (ii) With the help of a neat figure explain the graphical method of analysing the working of transistor as an amplifier in CE mode. **5**

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